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MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO) 16 Mar 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2001-057**
Drake, Greg W., "TTCP Ingredients for Energetic Materials: Air Force Research Laboratory, Edwards AFB, CA"

International Report to be used by Dr. May Chan (NAWC) **(Statement A)**
USA Focus Officer of TTCP WTP-4 Focus Area
"Ingredients for Energetic Materials" (Deadline 17 Mar 2001)

TTCP Ingredients for Energetic Materials: Air Force Research Laboratory, Edwards AFB, CA

Reporting Period: April 1, 2000 to March 31, 2001

Focus Officer: Greg Drake, AFRL/PRSP

Fundamental Chemisty in oxidizers: Work on novel polynitrogen continues at the Edwards Air Force Base in Karl Christe's group. The $N_5^+SbF_6^-$ salt was fully characterized and its crystal structure determined. The salt is thermally surprisingly stable (70° C) and exhibits very little impact sensitivity. Safer methods for the synthesis of $N_5^+SbF_6^-$ have been developed and the salt is routinely prepared on a 5g scale. Ongoing and future work is aimed at the syntheses of , combinations of N_5^+ with energetic counterions and novel large polynitrogen anions.

Monopropellant ingredients: Several new materials were looked at by Dr. Greg Drake's group. A complete reinvestigation of the highly energetic methylene bisoxyamine molecule, $CH_2(-O-NH_2)_2$ was carried out. The synthesis and characterization of a large array of energetic salts, both mono and bis, using energetic counterions including nitrate, perchlorate, dinitramide, and nitroformate anions were carried out. It was found that most of the materials had sensitivity issues on impact and friction, were hygroscopic, and failed thermal stability studies, with all salts losing significant mass in short periods of time. A single crystal x-ray diffraction study was carried out on the double perchlorate salt of methylene bisoxyamine, by Dr. Richard Gilardi of the U. S. Naval Research Laboratory. A manuscript has been submitted to the Journal of Energetic Materials, which covers all of this work.

Salts based on the energetic anion nitrocyanamide, $N(NO_2)(CN)^-$, have been synthesized and characterized. With small cations such as ammonium or hydrazinium, thermal stability problems are encountered. Investigations are continuing with larger cations such as the triaminoguanidinium cation, to see if more stable salts can be obtained.